What is claimed is:

1. A substrate processing system, comprising:

a vacuum chamber;

a substrate supporter, located within the vacuum chamber, for holding a substrate;

a gas manifold for introducing process gases into the chamber;

a gas distribution system, coupled to the gas manifold, for distributing the process gases to the gas manifold from gas sources;

a power supply coupled between the substrate supporter and the gas manifold;

a vacuum system for controlling pressure within the vacuum chamber;

a controller, including a computer, for controlling the gas distribution system, the power supply and the vacuum system; and

a memory coupled to the controller comprising a computer usable medium having a computer readable program code embodied therein for directing operation of the substrate processing system, the computer readable program code including:

computer readable program code for causing the gas distribution system to introduce a first process gas comprising a mixture of SiH_4 and N_2O into the chamber to deposit a first plasma enhanced CVD layer over the wafer; and

computer readable program code for causing the gas distribution system to introduce a second process gas comprising He into the chamber to control the deposition rate of the first layer.

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2. A substrate processing system as in claim 1 wherein the computer readable program code for causing the gas distribution system to introduce the first process gas comprising a mixture of SiH_4 and N_2O into the chamber controls the introduction of the SiH_4 to be between 5 to 300 sccm, and the rate of N_2O to be between 5 to 300 sccm.

3. A substrate processing system as in claim 2 wherein the computer readable program code for causing the gas distribution system to introduce a second process gas comprising He into the chamber controls the chamber pressure at about 1 to 6 torr.

4. A substrate processing system as in claim 3 wherein the computer readable program code for causing the gas distribution system to introduce the first process gas comprising a mixture of SiH_4 and N_2O into the chamber controls the introduction of the SiH_4 to be at a ratio of between 0.5 to 3 times the amount of N_2O.

5. A substrate processing system as in claim 1 further comprising:

computer readable program code for causing the gas distribution system to introduce a third process gas comprising NH_3 into the chamber; and

computer readable program code for causing the gas distribution system to introduce a fourth process gas comprising N_2 into the chamber.

6. A substrate processing system as in claim 5 wherein:

the computer readable program code for causing the gas distribution system to introduce a third process gas comprising NH_3 into the chamber controls the introduction of the NH_3 to be between a rate of 0 to 300 sccm; and

the computer readable program code for causing the gas distribution system to introduce a fourth process gas comprising N_2 into the chamber controls the introduction of the N_2 to be between a rate of 0 to 4000 sccm.

7. A substrate processing system as in claim 1 further comprising computer readable program code for controlling the gas distribution system to operate for a specified time period.

8. A substrate processing system as in claim 7 wherein the computer readable program code for controlling the gas distribution system to operate for a specified time period comprises computer readable program code for causing the first plasma

enhanced CVD layer to be formed to a thickness which is an odd multiple, greater than one, of a wavelength of light to be used in a subsequent process operation on the layer.

9. A substrate processing system as in claim 2 wherein the computer readable program code for causing the gas distribution system to introduce the first process gas comprising a mixture of SiH_4 and N_2O into the chamber controls the introduction of the SiH_4 to be between 15 to 160 sccm, and the rate of N_2O to be between a rate of 15 to 160 sccm.

10. A substrate processing system as in claim 9 further comprising:

computer readable program code for causing the gas distribution system to introduce a third process gas comprising NH_3 into the chamber at a rate of less than 150 sccm; and

computer readable program code for causing the gas distribution system to introduce a fourth process gas comprising N_2 into the chamber at a rate of less than 300 sccm.

11. A method for achieving plasma stability for a process during deposition of an antireflective layer in a processing chamber, the method comprising the steps of:

adding an amount of inert gas to the process to achieve a desired chamber pressure; and

controlling the amount of inert gas added to the process to control the processing chamber pressure.

12. The method of claim 11, wherein the inert gas comprises helium and the processing chamber pressure is between 4.5 and 5.5 torr.

13. A method for controlling a plasma enhanced process to achieve thickness control in thin film deposition, the method comprising the steps of:

determining an amount of an inert gas required to achieve a desired lower deposition rate;

adding the inert gas to the process; and

controlling the step of adding the inert gas to achieve the desired lower deposition rate.

14. The method of claim 13 wherein the inert gas comprises helium.

15. The method of claim 13 wherein the process comprises a plasma enhanced silane oxide process.

16. The method of claim 13 wherein the process comprises a plasma enhanced silane oxynitride process.

17. The method of claim 16 wherein the process comprises a plasma enhanced silane nitride process.

18. The method of claim 13 further comprising the steps of:

maintaining a chamber pressure in the range of 1-6 Torr;

connecting the chamber to a RF power supply;

supporting the substrate on a supporter;

heating the substrate;

introducing SiH_4 into the chamber at a rate of 5-300 sccm;

introducing N_2O into the chamber at a rate of 5-300 sccm;

19. The method of claim 18 wherein the step of heating comprises heating the substrate to a temperature in the range of 200-400°C.

20. The method of claim 18 wherein the step of supporting the substrate comprises placing the supporter at a distance from a gas distribution system in the range of 200-600 mils.

21. The method of claim 13 further comprising:
introducing NH_3 into the chamber at a rate of less than 300 sccm; and
introducing N_2 into the chamber at a rate of less than 4000 sccm.

22. The method of claim 13 further comprising the steps of:
forming an antireflective layer over a substrate;
forming a layer of additional material on the antireflective layer; and
wherein the antireflective layer comprises a film which, at a given exposure wavelength, will have a first reflection from an first interface between the additional material and the antireflective layer, and a second reflection from a second interface between the antireflective layer and the substrate, the second reflection being an odd number which is at least 3 multiplied by 180° out of phase with the first reflection, whereby the first and second reflections at least partially cancel each other.

23. The method of claim 22 wherein the additional material comprises photoresist.

24. The method of claim 23 wherein the antireflective layer has a refractive index in the range of 2.1-2.4, and an absorptive index in the range of 0.2-0.5.

25. The method of claim 24 wherein the antireflective layer has a thickness between 500-1000 angstroms.

26. A process for depositing an antireflective layer on a substrate in a semiconductor processing chamber comprising the steps of:
using He to provide a chamber pressure in the range of 1-6 Torr;
connecting the chamber to a RF power supply to receive 50 to 500 Watts;
supporting the substrate within the chamber;
heating the substrate to a temperature in the range of 200-400 °C;
introducing SiH_4 through a gas distribution system at a 5-300 sccm; and

introducing N_2O through the gas distribution system at a rate of 5-300 sccm.

27. The process of claim 26 further comprising the step of introducing NH_3 into the chamber at a rate of 0-300 sccm.

28. The process of claim 27 further comprising the step of introducing N_2 into the chamber at a rate of 0-4000 sccm.

29. The process of claim 26 wherein the He is introduced into the chamber at a rate of 5-5000 sccm.

30. The process of claim 26, wherein the antireflective layer has a refractive index n, an absorptive index k, a thickness t, and a reflectance r, the process further comprising the step of increasing the rate at which the NH_3 is introduced into the chamber to cause the refractive index n and the thickness t to increase, and the absorptive index k and the reflectance r to decrease.

31. The process of claim 26, wherein the antireflective layer has a refractive index n, an absorptive index k, a thickness t, and a reflectance r, the process further comprising the step of increasing the rate at which the N_2 is introduced into the chamber to cause the refractive index n, the absorptive index k, and the reflectance r to decrease, and the thickness t to increase.

32. The process of claim 26, wherein the antireflective layer has a refractive index n, an absorptive index k, a thickness t, and a reflectance r, the process further comprising the step of increasing the rate at which the He is introduced into the chamber to cause the refractive index n, the absorptive index k, and the reflectance r to increase, and the thickness t to decrease.

33. The process of claim 26, wherein the antireflective layer has a refractive index n, an absorptive index k, a thickness t, and a reflectance r, the process further comprising the step of increasing the temperature to cause the refractive index n, the absorptive index k, the thickness t, and the reflectance r to increase.

34. The process of claim 26, wherein the antireflective layer has a refractive index n, an absorptive index k, a thickness t, and a reflectance r, the process further comprising the step of increasing the chamber pressure to cause the refractive index n, the absorptive index k, the thickness t, and the reflectance r to decrease.

35. The process of claim 26, wherein the antireflective layer has a refractive index n, an absorptive index k, a thickness t, and a reflectance r, the process further comprising the step of increasing the power supplied to the chamber to cause the refractive index n, the absorptive index k, and the reflectance r to decrease, and the thickness t to increase.

36. The process of claim 26, wherein the antireflective layer has a refractive index n, an absorptive index k, a thickness t, and a reflectance r, the process further comprising the step of increasing the distance between the supporter and the gas distribution system to cause the refractive index n, the absorptive index k, the thickness t, and the reflectance r to decrease.

37. The process of claim 26, wherein the antireflective layer has a refractive index n, an absorptive index k, a thickness t, and a reflectance r, the process further comprising the step of increasing the rate at which SiH_4 is introduced into the chamber to cause the refractive index n, the absorptive index k, the thickness t, and the reflectance r to increase.

38. The process of claim 26, wherein the antireflective layer has a refractive index n, an absorptive index k, a thickness t, and a reflectance r, the process further comprising the step of increasing the rate at which N_2O is introduced into the

chamber to cause the refractive index n, the absorptive index k, and the reflectance r to decrease, and the thickness t to increase.

39. A method of forming a photoresist pattern, the method comprising the steps of:

forming an antireflective layer on a substrate; and

forming a layer of photoresist on the antireflective layer, the layer having a thickness and refractive indices such that a first reflection from an interface between the photoresist and the antireflective layer will be at least 540° out of phase with a second reflection from an interface between the antireflective layer and the substrate.

40. The method of claim 39 wherein:

the substrate comprises Al;

the first and second reflections are from light having a wavelength of about 248 nm; and

wherein the antireflective film has a refractive index n in the range of 2.1-2.4, an absorptive index k in the range of 0.2-0.5, and a thickness t in the range of 500-1000 angstroms.

41. The method of claim 40 wherein the substrate further comprises at least one of Si and Cu.

42. The method of claim 39 wherein light is used to expose the photoresist, and the light has a wavelength in the range of 190-900 nm.

43. An improved antireflective layer for use in the manufacture of semiconductor devices comprising:

a layer comprising SiON having a refractive index n in the range of 1.7-2.9, an absorptive index k in the range of 0-1.3, and a thickness in the range of 200-3000 angstroms; and

wherein at an exposure wavelength of 365 nm or less, a phase shift of an odd multiple of at least 3 multiplied by 180° exists between a first reflection from an interface between an overlying layer of photoresist and the antireflective layer and a second reflection from an interface between the antireflective layer and a substrate, the first reflection having almost the same intensity as the second reflection to there by substantially cancel the first and the second reflections.

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B^2